

East Valley Asphalt Committee
HOT ASPHALT MIX CRITERIA

Revised August 2008
Effective December 1, 2008

In an effort to standardize asphalt mix designs in the East Maricopa County area, the Cities of Chandler, Gilbert, Mesa, Scottsdale, Tempe and the Town of Queen Creek formed an East Valley Asphalt Committee (EVAC). The Committee established the following procedure for submitting, reviewing and approving asphalt mixes. Once the asphalt mix design is approved, the mix may be used in any of the six communities per approved plans, details and specifications. The following is the procedure for asphalt producers to obtain approval of their asphalt mixes.

I. General Information:

- A. Who needs to submit: All producers of hot asphalt concrete whose mixes may be placed within the right-of-ways of the cities of Chandler, Gilbert, Mesa, Scottsdale, Queen Creek and/or Tempe.
- B. Where to submit: Two (2) copies of the reports shall be submitted to the Chairman of the East Valley Asphalt Committee (City of Mesa) with the appropriate cover sheet,
- C. When to submit: New approvals or re-approvals of asphalt mixes, hot mix facilities, and laboratory certifications will be required on an annual basis. The submittals will be due by the first workday in January for approval by the following first workday of February. Submittals are to be submitted by end of business February 2nd, 2009. After that date, submittals may experience significant delays in the approval process. Additional submittals may be required when the committee, in their judgment, the product in the field is not meeting the design or as required in the following criteria.
- D. A format is included in this document for itemizing data critical to the mix design review. Completion of this format is necessary for acceptance of each mix design. Please use the 'ENGINEERING MATERIALS LAB – Arterial/Residential Mix Design Information Input Sheet. This cover sheets are located either online or at the back of this packet.
- E. Many of the references provided herein are to Maricopa County Association of Government's Uniform Standard Specifications and Details. The details and sections refer to are the 2008 versions. The current version is not reflected as a reference in criteria below.

II. Laboratory Requirements:

A laboratory knowledgeable in asphalt mix design must perform the mix designs. The laboratory may be the hot mix asphalt producer's laboratory or a commercial geotechnical materials laboratory provided each comply with the following:

- A. The laboratory is, at the time of submittal, certified by the National Bureau of Standards in the National Voluntary Laboratory Accreditation Program (NVLAP) for Construction Services (ASPHALT) or the AASHTO Accreditation Program in Hot Mix Asphalt (AAP). A copy of the certification will be required with each submittal as described above.
- B. The laboratory is under direct supervision of an experienced (5 years minimum) Arizona registered Professional Civil Engineer in the development of asphalt concrete mix designs. This will also require the Engineer to be physically present on a routine basis while the mix design testing is being done and be the responsible person in charge of the work.
- C. If the laboratory is approved by the Arizona Department of Transportation (ADOT) to perform asphalt concrete mixture designs, a copy of the personnel resource data that is supplied to ADOT, along with a copy of their approved letter will suffice.
- D. The Engineer shall place his seal (stamp), signature, and date on each mix design.

III. Mix Designs:

- A. Annual mix designs will be required as indicated in Part I above. Mix designs older than 3 months will not be accepted. If, in the opinion of the committee, the test data from the mix is not meeting the approved design or if conditions at the plant change, additional submittals will be required. The scope of additional submittals may vary depending on the degree of proof required to establish or re-establish a workable design. The following is a list of conditions, which the committee considers to be sufficient grounds to justify re-evaluation of the mix design.
 - 1. A change in the producer's pit.
 - 2. A change in the asphalt binder, including modifiers.
 - 3. When material is taken from a different or new source.
 - 4. A change in the producer's method of aggregate production.
 - 5. When production tests fall outside the parameters established in Section III D below.
 - 6. Any other change that will cause an adjustment in the asphaltic concrete mix design. Note: Individual or additional asphalt mix designs not submitted during the established review period will not be reviewed for inclusion onto the current approved asphalt mixes list.

- B. Design of the asphalt paving mixture shall be accomplished by either the Marshall Method of Mix Design (75 blows) as described in the latest edition of the MS-2 manual or the Gyratory method as described in the latest edition of the SuperpaveTM Volumetric Mix Design Manual (SP-2), published by the Asphalt Institute (AI). A minimum of 4 points will be used to establish the mix design results. Optimum asphalt content will be selected at an air void content of 4.0% plus or minus 0.2. The proposed mix design must further comply with all requirements of Section III-D.
- C. The asphalt mix design submittal will include the following information:
1. The mix design will be stamped, signed and dated by the Engineer responsible for the mix design.
 2. A unique product code for each mix design.
 3. Grade of asphalt binder, including type of modifiers if present.
 4. Recommended asphalt binder content.
 5. Asphalt supplier with certifications for the material.
 - 6a. For Marshall Mix designs: stability and flow.
 - 6b. For SuperpaveTM Mix designs: number of gyrations at initial, design and maximum.
 7. Anti-strip supplier with certifications for the material.
 8. Method to add anti-strip agent to the aggregate.
 9. Specific gravity of aggregates (bulk, bulk SSD, apparent and effective).
 10. Specific gravity of anti-strip agent and asphalt binder.
 11. Maximum specific gravity of asphalt mixture.
 12. Bulk density.
 13. Moisture sensitivity.
 14. Aggregate proportions (including anti-strip agent) based on bin percentages and composite gradation. The composite plotted on a graph raised to 0.45 power gradation chart.
 15. Sand Equivalent.
 16. Fractured face count.
 17. Plasticity Index.
 18. Percent voids in mineral aggregate.
 19. Percent voids filled.
 20. Percent effective air voids.
 21. Dust proportion.
 22. Film thickness.
 23. Unconfined void content.
 24. Mixing and compaction temperatures.
 25. Plant and Laboratory Certifications.

D. Mix Design Criteria:

There will be two types of designs. One for the high volume heavy traffic arterial, major collector and industrial streets as determined by the Engineer ("A" mixes) and

one for the local residential and collector streets as determined by the Engineer (“R” mixes). Both shall use the Performance Grade Asphalt Binder Specification and the Superpave™ gradation as described in the latest edition of the SP-1 and SP-2 manuals published by the Asphalt Institute. The gradation curve for the arterial, major collector and industrial streets shall fall below the restricted zone while the local residential and collector streets shall fall above the zone. Also, the mix design for arterial, major collector and industrial streets shall comply with the Superpave™ Level 1 Mix Design while the local residential and collector streets shall comply with the Marshall Method of Mix Design as described in the latest edition of the MS-2 manual published by The Asphalt Institute. The mixes shall comply with the following limits/standards:

	ITEM	LIMITS/STANDARDS	REFERENCE
a.	Asphalt Mixes (Designation)	1. Arterial, Major Collector & Industrial Streets: A-1/2” (12.5mm), A-3/4” (19 mm), and A-1” (25mm) 2. Local Residential & Collector Streets: R-1/2” (12.5mm), R-3/4” (19mm), and R-1” (25mm)	MAG Table 710-1
b.	Asphalt Binder	1. Arterial, Major Collector & Industrial Streets: PG 70-10 2. Local Residential & Collector Streets: PG 64-10	MAG Table 711-1
c.	Asphalt Binder Content Asphalt Binder Content	Arterial, Major Collectors & Industrial Streets: Design: 5.0% to 6.0% (12.5), 4.5% to 5.5% (19) and 3.5% to 5.0% (25) Local Residential & Collector Streets: Design: 5.5% to 6.5% (12.5), 5.0% to 6.0% (19) and 4.0% to 5.0% (25)	MAG Table 710-7
d.	Mix Design Methods	1. Arterial, Major Collector & Industrial Streets: Superpave™ Level 1 Design: Gyrations: (1-3 x 10 ⁶ ESAL’s at 43-44° C) N _{Initial} 8 N _{Design} 100 N _{Maximum} 160	MAG Table 710-6, High Traffic

		2. Local Residential & Collector Streets: Marshall Mix Design-75 Blows Stability: 8 kN Min. Flow, 1" 0.25 mm: 8 to 16	MAG Table 710-5, High Traffic
e.	Effective Air Voids	Design: 4% ± 0.2	MAG Table 710-5 High Traffic & MAG Table 710-6 High Traffic
f.	Anti-Stripping Agent	Hydrated Lime: 0.75% min. by wt. or Portland Cement: 1.00% min. by wt.	MAG 710.2.3
g.	Unit Weight	Design: N/A Production: $\pm 64 \text{ kg/m}^3$ (average)	
h.	Moisture Sensitivity	1. Aggregate gradation below restricted zone Dry tensile strength 500 kPa Minimum Tensile Strength Ratio 0.70 Minimum 2. Aggregate gradation above restricted zone Dry tensile strength 750 kPa Minimum Tensile Strength Ratio 0.60 Minimum	MAG 710.3.6
i.	Gradation	Design: 1/2" (12.5 mm) nominal size, 3/4" 19 mm) nominal size and 1" (25 mm) nominal size	MAG Table 710-1
			MAG Table 710-2 & 710-3
J.	Sand Equivalent	1. Arterial, Major Collector & Industrial Streets, the gradation curve shall fall <u>BELOW</u> the restricted zone.	MAG Table 710-4 (version 2008 or see City of Mesa Amendments)
		2. Local Residential & Collector Streets, the gradation curve shall be placed <u>ABOVE</u> the restricted zone	
		1. Arterial, Major Collector & Industrial Streets 50.0% Min 2. Local Residential & Collector Streets 50.0% Min	

k.	Fractured Face	1. High Volume Traffic (Arterial, Major Collector & Industrial Streets) 85.0 % 1 or more faces 80.0 % 2 or more faces 2. (Local Residential & Collector Streets) 85.0% 1 or more faces 80.0 % 2 or more faces	MAG Table 710-4
l.	Plasticity Index	Non-plastic for all mixes	MAG Table 710-4
m.	Percent Voids in Mineral Agg.	14.0% (1/2"), 13.0% (3/4") & 12.0% (1") Min.	MAG Table 710-8
n.	Percent Voids Filled (VFA)	1. Arterial & Major Collector & Industrial Streets: 65% to 75% 2. Local Residential & Collector Streets: 70% to 80%	MAG Table 710-6
o.	Dust Proportion	1. Arterial, Major Collector & Industrial Streets 0.6 – 1.2 2. Local Residential & Collector Streets 0.8- 1.4	MAG 710-3.5
p.	Film Thickness	1. Arterial & Major Collector & Industrial Streets: 8 to 14 microns 2. Local Residential & Collector Streets: 10-14 microns	MAG Table 710-6
q.	Uncompacted Void Content	1. Arterial & Major Collector Industrial Streets: 45% Min. 2. Local Residential & Collector Streets: 42% Min.	MAG Table 710-4
r.	Sound Crushed Rock And Gravel	1. Grading A, shall not exceed 10 percent, by weight, after 100 revolutions nor 40 percent after 500 revolutions	MAG 701.2

See attached table allowable aggregate variation during production.

MAG Table 710-9	
Allowable Aggregate Variation (Production)	
Maximum Aggregate Size	100% Passing
Nominal Maximum Aggregate Size	+/- 7%
2.36mm to Nominal Maximum Aggregate Size	+/- 6%
0.150 mm and .600 mm Sieve	+/- 4%
0.075 mm Sieve	+/- 2%

Aggregate soundness and durability tests routinely submitted as “Historical” information shall be performed annually.

The calculated film thickness shall be calculated by the following formula:

$$T_f = \frac{4876.8 (P_{be})}{(SA) (P_s) (G_b)}$$

Note: The formula in MAG determines SA is in square feet per pound yet the film thickness is in microns, so the constant in the numerator is different.

Where,

T_f	=	Asphalt Film thickness, Microns
P_{be}	=	Effective Asphalt Content, percent by total weight of mixture
SA	=	Surface Area of Aggregate (square feet per pound)
P_s	=	Aggregate Content, Percent by Total weight of Mixture
G_b	=	Specific Gravity of Asphalt Cement Binder

- E. Any asphalt requirement not noted above shall be per MAG 710 unless specified differently in project specifications or supplements to MAG.

IV. Hot Mix Facilities:

The following information regarding the hot mix facilities shall be submitted for review with the mix designs or whenever a new facility is placed in operation or a facility is moved.

- A. Listing of all hot mix facility numbers, their physical locations, and the mixes (mix numbers) each will be producing.
- B. Annual certificates on all weights and metering devices used in the production and weighing of the asphalt mix.
- C. Each supplier will submit annually the Arizona Rock Products Association (ARPA) “Certification of Hot Mix Asphalt Production Facilities”.

APPROVALS:

City of Mesa

By: s/ *Elizabeth Huning*
City Engineer
Date: 10 2007

Town of Gilbert

By: s/ *Rick Alfred*
Town Engineer
Date: 10 2007

City of Tempe

By: s/ *Andy Goh*
City Engineer
Date: 10 2007

City of Scottsdale

By: s/ *Daniel Worth*
City Engineer
Date: 10 2007

City of Chandler

By: s/ *Sheina Hughes*
City Engineer
Date: 10 2007

Town of Queen Creek

By: s/ *Jim Leubner*
Town Engineer
Date: 10 2007



ENGINEERING MATERIALS LAB

Arterial Mix Design Information Input Sheet

MIX:

Type	
Supplier	
Plant Number	
Plant Location	
Product Code	
Supplier Lab Number	
Design Date	
Date Submitted	
Review Date	
Reviewed by	

DESIGN LAB:

Name of Design Lab	
NVLAP or AASHTO Accreditation?	
ARPA Certification?	
Asphalt Binder Certification?	
Admix Certification?	
Bin Percentages w/ Sieve Analysis?	
Combined Aggregate Gradation?	
Gradation is Within Limits (below restricted zone)?	
Received Design P.E. Stamp and Resume?	

BINDER PROPERTIES:

Design Binder Content (%)	
Binder Source	
Binder Grade	
Binder Specific Gravity	
Mixing Temperature (°F)	
Compaction Temperature (°F)	
Film Thickness	

AGGREGATE PROPERTIES:

Coarse Aggregate Specific Gravity (Bulk OD)	
Coarse Aggregate Specific Gravity (Bulk SSD)	
Coarse Aggregate Specific Gravity (Apparent)	
Fine Aggregate Specific Gravity (Bulk OD)	
Fine Aggregate Specific Gravity (Bulk SSD)	
Fine Aggregate Specific Gravity (Apparent)	
Combined Specific Gravity (Bulk OD)	
Effective Specific Gravity	
Combined Water Absorption (%)	
Dust Proportion	
Sand Equivalent	
Fractured Face One Count (%)	
Fractured Face Two Count (%)	
Flat and Elongated Particles (%)	
Uncompacted Void Content (%)	
L.A. Abrasion @ 500 Revolutions (%)	
Asphalt Absorption (%)	
Plasticity Index	

ADMIX PROPERTIES:

Admix Content (%)	
Admix Type	
Admix Source	
Admix Specific Gravity	
Admix Addition Method	

TENSILE RATIO:

U.S. Customary or Metric?	
Dry Tensile Strength (psi)	
Wet Tensile Strength (psi)	
Tensile Strength Ratio	

PROPERTIES @ NDESIGN:

Maximum Theoretical Specific Gravity (Gmm)	
Effective Binder Content (Pbe)	
Bulk Density / Unit Weight (Kg/m3)	
Bulk Specific Gravity (Gmb)	
Percent Air Voids (Va)	
Voids Mineral Aggregate (VMA)	
Percent Voids Filled (VFA)	
Gyrations @ N Initial	
Gyrations @ N Design	
Gyrations @ N Maximum	



ENGINEERING MATERIALS LAB

Residential Mix Design Information Input Sheet

MIX:

Type	
Supplier	
Plant Number	
Plant Location	
Product Code	
Supplier Lab Number	
Design Date	
Date Submitted	
Review Date	
Reviewed by	

DESIGN LAB:

Name of Design Lab	
NVLAP or AASHTO Accreditation?	
ARPA Certification?	
Asphalt Binder Certification?	
Admix Certification?	
Bin Percentages w/ Sieve Analysis?	
Combined Aggregate Gradation?	
Gradation is Within Limits (above restricted zone)?	
Received Design P.E. Stamp and Resume?	

BINDER PROPERTIES:

Design Binder Content (%)	
Binder Source	
Binder Grade	
Binder Specific Gravity	
Mixing Temperature (°F)	
Compaction Temperature (°F)	
Film Thickness	

AGGREGATE PROPERTIES:

Coarse Aggregate Specific Gravity (Bulk OD)	
Coarse Aggregate Specific Gravity (Bulk SSD)	
Coarse Aggregate Specific Gravity (Apparent)	
Fine Aggregate Specific Gravity (Bulk OD)	
Fine Aggregate Specific Gravity (Bulk SSD)	
Fine Aggregate Specific Gravity (Apparent)	
Combined Specific Gravity (Bulk OD)	
Effective Specific Gravity	
Combined Water Absorption (%)	
Dust Proportion	
Sand Equivalent	
Fractured Face One Count (%)	
Fractured Face Two Count (%)	
Flat and Elongated Particles (%)	
Uncompacted Void Content (%)	
L.A. Abrasion @ 500 Revolutions (%)	
Asphalt Absorption (%)	
Plasticity Index	

ADMIX PROPERTIES:

Admix Content (%)	
Admix Type	
Admix Source	
Admix Specific Gravity	
Admix Addition Method	

TENSILE RATIO:

U.S. Customary or Metric?	
Dry Tensile Strength (psi)	
Wet Tensile Strength (psi)	
Tensile Strength Ratio	

PROPERTIES AT DESIGN BINDER CONTENT:

Maximum Theoretical Specific Gravity (Gmm)	
Effective Binder Content (Pbe)	
Bulk Density / Unit Weight (pcf)	
Bulk Specific Gravity	
Percent Air Voids (Va)	
Voids Mineral Aggregate (VMA)	
Percent Voids Filled (VFA)	
Maximum Theoretical Density (pcf)	
Stability (N)	
Stability (lb)	
Flow	